CLAIMS

What is claimed is:

1. A method of generating a high-level vacuum comprising:

evacuating a chamber having a substantially-pure gas therein; and

freezing residual gas in the chamber to generate a high-level vacuum within the chamber.

2. The method of claim 1 wherein evacuating comprises evacuating the chamber to a medium-level vacuum.

3. The method of claim 1 further comprising purging impurities from the chamber with the gas by filling the chamber with the gas.

4. The method of claim 3 wherein filling comprises at least slightly pressurizing the chamber with the gas.

5. The method of claim 3 further comprising repeating the filling and the purging to reduce impurities from the chamber and to obtain a high concentration of the gas within the chamber.

6. The method of claim 5 further comprising, after filling the chamber with the gas, evacuating the chamber prior to freezing to generate a medium-level vacuum.

7. A method of claim 6 wherein the medium-level vacuum ranges between approximately $1x10^{-2}$ Torr and $5x10^{-2}$ Torr.

8. The method of claim 6 wherein the substantially-pure gas has in impurity-level of less than approximately 100 parts per million (PPM), and

wherein the gas is carbon-dioxide and has a freezing point of above approximately 100 degrees Kelvin at the medium-level vacuum.

9. The method of claim 6 wherein the chamber comprises a magnet chamber having a magnet therein, and wherein freezing comprises reducing the temperature within the chamber by cooling the magnet to at or below a freezing point of the gas at the medium-level vacuum.

10. The method of claim 9 further comprising after freezing the gas, further cooling the magnet to a cryogenic temperature,

wherein the vacuum within the chamber is to provide insulation for the cryogenically-cooled magnet.

11. The method of claim 1 wherein freezing comprises generating the high-level vacuum ranging between approximately $1x10^{-5}$ Torr and $1x10^{-8}$ Torr.

12. The method of claim 1 wherein the gas comprises substantially-pure water vapor having an impurity level of less than approximately 100 PPM.

13. A vacuum insulation system comprising:

a chamber having a substantially-pure gas therein at less than atmospheric pressure; and

a cooling element to freeze residual gas in the chamber to generate a high-level vacuum within the chamber.

14. The system of claim 13 further comprising a medium-level vacuum pump to reduce the pressure within the chamber to a medium-level vacuum before the cooling element operates to freeze the gas.

15. The system of claim 14 wherein the medium-level vacuum ranges between approximately $1x10^{-2}$ Torr and $5x10^{-2}$ Torr.

16. The system of claim 14 further comprising one or more values operable to allow the gas into the chamber for purging the chamber with the gas,

and operable to allow the medium-level vacuum pump to evacuate the chamber to the medium-level vacuum.

17. The system of claim 14 further comprising one or more values operable to allow the gas into the chamber for repeatedly purging the chamber with the gas, and operable to repeatedly allow the medium-level vacuum pump to evacuate the chamber to the medium-level vacuum.

18. The system of claim 17 further comprising a system controller to operate the one or more valves, the vacuum pump and the cooling element, to repeatedly purge the chamber with the gas, to evacuate the chamber to the medium-level vacuum, and to cool the chamber.

19. The system of claim 14 further comprising a gas cylinder having the substantially-pure gas therein at a higher-than atmospheric pressure, the gas cylinder to at least slightly pressurize the chamber with the gas prior to the vacuum pump evacuating the chamber before freezing.

20. The system of claim 14 wherein the substantially-pure gas has an impurity-level of less than approximately 100 parts per million (PPM), and

wherein the gas is carbon-dioxide and has a freezing point of above approximately 100 degrees Kelvin at the medium-level vacuum.

21. The system of claim 14 further comprising a magnet within the chamber, and wherein the cooling element is to reduce a temperature within the chamber by cooling the magnet to at or below a freezing point of the gas at the medium-level vacuum.

22. The system of claim 21 wherein after freezing the gas, the cooling element is to further cool the magnet to a cryogenic temperature, and wherein the high-level vacuum within the chamber is to provide insulation for the cryogenically-cooled magnet.

23. The system of claim 13 wherein when the high-level vacuum ranges between approximately $1x10^{-5}$ and $1x10^{-8}$ Torr.

24. The system of claim 13 wherein the gas comprises substantially-pure water vapor having an impurity level of less than 100 parts per million.

25. The system of claim 13 wherein the cooling element is coupled to a cryogenic cooler to cool the cooling element and dissipate heat.

26. The system of claim 20 wherein the magnet is an electromagnet cooled to a superconducting temperature to generate a high-level magnetic field for a radar tube in a radar system.

27. The system of claim 20 wherein the magnet is superconducting magnet in a magnetic-resonance-interference (MRI) diagnostic imaging system.

28. The system of claim 13 wherein the chamber is to insulate an infrared seeker head of a missile, the chamber being provided with the substantially-pure gas therein, and

wherein the system further comprises a cooling liquid to freeze the substantially-pure gas within the chamber after launch of the missile to generate in flight the high-level vacuum within the chamber, the cooling liquid to further cool the seeker head to at least a near-cryogenic temperature.

29. The system of claim 28 wherein the cooling liquid comprises liquid argon, and wherein the substantially-pure gas is carbon-dioxide, and wherein the chamber is initially provided with the medium-level vacuum.

30. A radar system comprising:

an electromagnet; and

a vacuum insulation system to insulate the electromagnet, the vacuum insulation system comprising a vacuum chamber having a substantially-pure gas

therein at less than atmospheric pressure, a cooling element to freeze the gas for generating a high-level vacuum within the chamber,

wherein the electromagnet is to generate a magnetic field for use in controlling a path of an electron beam in an RF power tube of a transmitter of the radar system, and

wherein the electromagnet has windings that become superconducting when cooled by the cooling element and insulated by the high-level vacuum.

31. The system of claim 30 further comprising:

a medium-level vacuum pump to reduce the pressure within the chamber to a medium-level vacuum before the cooling element operates to freeze the gas;

one or more values operable to allow the gas into the chamber for repeatedly purging the chamber with the gas, and operable to repeatedly allow the medium-level vacuum pump to evacuate the chamber to the medium-level vacuum; and

a gas cylinder having the substantially-pure gas therein at a higher-than atmospheric pressure, the gas cylinder to at least slightly pressurize the chamber with the gas prior to the vacuum pump evacuating the chamber before freezing, wherein the substantially-pure gas has an impurity-level of less than approximately 100 parts per million (PPM).

32. The system of claim 31 further comprising a system controller to operate the one or more valves, the vacuum pump and the cooling element, to repeatedly purge the chamber with the gas, to evacuate the chamber to the medium-level vacuum, and to cool the chamber.

33. The system of claim 31 wherein the medium level vacuum ranges between approximately $1x10^{-2}$ Torr and $5x10^{-2}$ Torr, and the high-level vacuum ranges between approximately $1x10^{-5}$ and $1x10^{-8}$ Torr.

34. A missile comprising:

a vacuum insulating chamber to insulate an infrared seeker head, the chamber provided with a substantially-pure gas therein; and

a cooling liquid to freeze the substantially-pure gas within the chamber after launch and to generate in flight, a high-level vacuum within the chamber, the cooling liquid to also cool the seeker head.

35. The missile of claim 34 wherein the cooling liquid comprises liquid argon, and wherein the substantially-pure gas is carbon-dioxide, and wherein the chamber is initially provided with a medium-level vacuum.

36. The missile of claim 35 wherein the medium level vacuum ranges between approximately $1x10^{-2}$ Torr and $5x10^{-2}$ Torr, and the high-level vacuum ranges between approximately $1x10^{-5}$ and $1x10^{-8}$ Torr.